

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) An integrated optical device comprising:

an optical substrate, ~~wherein~~ defining a non-guiding propagation region for an
incident light signal is ~~propagating within the substrate~~ propagating in a primary direction of
propagation ~~reflecting off a top surface of the substrate~~ under total internal reflection at a
surface of the substrate; and

a diffractive optical element having a plurality of spaced-apart members formed of an
optically transparent material and disposed above the ~~top~~ surface of the substrate such that the
incident light signal incident on the surface under total internal reflection is reflected into the
non-guiding propagation region ~~within the substrate~~ along a desired direction of propagation
different than the primary direction of propagation.

2. (Original) The integrated optical device of claim 1, wherein the substrate is
formed of quartz.

3. (Original) The integrated optical device of claim 1, wherein the substrate is
formed of sapphire.

4. (Original) The integrated optical device of claim 1, wherein the members are a
plurality of strips that are substantially parallel.

5. (Original) The integrated optical device of claim 4, wherein the plurality of
strips each have a substantially identical strip width.

6. (Original) The integrated optical device of claim 4, wherein the plurality of
strips are each spaced apart a substantially equal spacing distance.

7. (Original) The integrated optical device of claim 4, wherein the plurality of
strips each have a substantially identical strip width, the plurality of strips are each spaced

apart a substantially equal spacing distance, and the spacing distance is substantially identical to the strip width.

8. (Original) The integrated optical device of claim 7, wherein the sum of the distance and width is between $.5\lambda$ and 4λ , where λ is the wavelength of the light signal in the substrate.

9. (Currently Amended) The integrated optical device of claim 1, wherein the thickness of the members is adjusted to maximize the intensity of the reflected light signal.

10. (Original) The integrated optical device of claim 1, wherein the members are formed of a material selected from the grouping consisting of amorphous silicon, crystalline silicon, and poly-silicon.

11. (Original) The integrated optical device of claim 1, wherein the members are formed of a material selected from the grouping consisting of alumina, sapphire, silicon nitride, and an alloy of poly-silicon and poly-germanium.

12. (Currently amended) The integrated optical device of claim 1, wherein the incident light signal propagates as a first unguided wave within the substrate, wherein the diffractive optical element is disposed to reflect the incident light signal as a second unguided wave within the substrate, and wherein the members are disposed in direct contact with the top surface of the substrate.

13. (Cancelled without prejudice)

14. (Original) The integrated optical device of claim 1, wherein the diffractive optical element produces a first order diffracted mode that travels within the substrate in the desired direction of propagation at an angle to the primary direction of propagation.

15. (Original) The integrated optical device of claim 14, wherein the first order diffracted mode travels within the substrate under total internal reflection.

16. – 17. (Withdrawn without prejudice)

18. (Original) The integrated optical device of claim 1, wherein the light beam is coupled into the substrate through a GRIN lens.

19. (Original) The integrated optical device of claim 1, wherein the members are substantially parallel linear elements.

20. (Currently amended) The integrated optical device of claim 1, wherein the members are formed on the top surface of the substrate by depositing a silicon material in a patterned form.

21. (Original) The integrated optical device of claim 1, wherein the members and the substrate are formed of the same material.

22. (Original) The integrated optical device of claim 21, wherein the material is sapphire.

23. (Original) The integrated optical device of claim 1, where the members have a higher index of refraction than that of the substrate.

24. (Original) The integrated optical device of claim 1, where the diffractive optical element operates by means of total internal reflection.

25. (Currently Amended) The integrated optical device of claim 1, comprising a plurality of incident light signals propagating within the substrate each having a different wavelength and wherein the diffractive optical element reflects each of the plurality of incident light signals into a different first order diffracted mode as a reflected light signal that travels within the substrate in one of plurality of second directions of propagation each at an angle to the primary direction of propagation, ~~and such that each reflected light signal travels~~ traveling within the substrate under total internal reflection.

26. (Original) The integrated optical device of claim 1, wherein the members each have a width selected to maximize the intensity of the reflected light signal.

27. (Original) The integrated optical device of claim 1, wherein the members are formed of a plurality of strips, each strip having a width and an associated spacing, wherein the widths and the spacings vary among the strips.

28. (Original) The integrated optical device of claim 27, wherein the widths and the spacings vary in a continuous manner.

29. (Currently amended) A diffraction grating for use with an optically transparent substrate, the diffraction grating comprising:

a plurality of members formed of an optically transparent material and disposed above a ~~top~~ surface of the substrate, the members being spaced apart a spacing distance and having member widths, whereby the sum, a , of the spacing distance and the member width is chosen such that a light signal traveling within the substrate under total internal reflection off the ~~top~~ surface in an incident direction of propagation and incident upon the diffraction grating is reflected into a first diffracted order propagating within the substrate in a reflected direction of propagation defining an angle, θ_p , with respect to the incident direction of propagation and propagating within the substrate under total internal reflection, wherein the light signal is incident upon the diffraction grating at an angle, θ , above a critical angle, θ being measured from a normal to the ~~top~~ surface of the substrate extending into the substrate, and wherein the sum a is chosen such that θ_p is greater than 90° and less than 180° .

30. (Original) The diffraction grating of claim 29, wherein the sum, a , is between $.5\lambda$ and 4λ , where λ is the wavelength of the light signal within the substrate.

31. (Original) The diffraction grating of claim 30, wherein λ is between $.25 \mu\text{m}$ microns and $10 \mu\text{m}$ microns.

32. (Cancelled without prejudice)

33. (Original) The diffraction grating of claim 29, wherein the spacing distance is substantially identical to the member width.

34. (Original) The diffraction grating of claim 29, wherein the members are formed of a material selected from the grouping consisting of amorphous silicon, crystalline silicon, and poly-silicon and wherein the substrate is formed of sapphire.

35. (Original) The diffraction grating of claim 29, wherein the members have an index of refraction higher than the index of refraction of the substrate.

36. – 46. (Withdrawn without prejudice.)

47. (Added) An integrated optical device comprising:

an optical substrate disposed to propagate an incident light signal, in a primary direction of propagation, under total internal reflection at a surface of the substrate; and

a diffractive optical element having a plurality of spaced-apart members formed of an optically transparent material and disposed above the top surface of the substrate such that the incident light signal incident on the surface under total internal reflection is reflected within the substrate along a desired direction of propagation different than the primary direction of propagation, wherein the plurality of spaced-apart members are disposed in evanescent field coupling contact with the surface of the substrate.
